Process Evaluation Section

Background

The Process Evaluation Section conducts applied research to develop advanced technologies for industrial applications. The core activities of the section include physical/chemical separation process development, metallurgical process development, and process simulation and cost analyses. Historically, this section focused on development of materials recycling technologies, with our funding provided primarily by DOE's Office of Industrial Technologies (OIT). All of our projects were then, as they are now, cost-shared by industrial partners.

Today, most of the Section's funding is from OIT's Industries of the Future (IOF) Program. We have projects with the aluminum, chemicals, petroleum and glass IOFs. While many of the projects are still related to materials recycling, an increasing share of our work extends to new process development.

As a result of our success and reputation in materials recycling, we are developing and leading the Partnership for a New Generation of Vehicles (PNGV) Recycle Program for the Office of Advanced Transportation Technologies.

Representative research projects include the following:

Development of a process for recovery of bulk materials and polyurethane foam from auto shredder residues. Bench-scale research on this process (U.S. Patent No. 5,882,432, *Efficient Continuous Dryer for Flexible Polyurethane Foam and Cleaning Apparatus*, March 1999) was initiated in 1990 and completed in 1997 after successful operation of a pilot-plant at a shredder facility. The process was licensed to Salyp, N.V. of Belgium in 1999. Salyp is currently building a full-scale demonstration facility that is expected to be operational in the summer of 2001 and will market this technology on a worldwide basis. This process received an R&D 100 Award in 2000.

Development of a froth-flotation process for the separation and recovery of high-purity ABS from mixed plastics. This process (U.S. Patent No. 5,653,867, *Method for Separation of High Impact Polystyrene [HIPS] and Acrilonitrile Butadiene Styrene [ABS] Plastics*) has been successfully piloted at a host facility. ABS recovered from the mixed plastics from obsolete appliances was successfully used in injection molding of automotive parts. The basic technology has also been adapted for recovery of selected thermoplastics from the plastics concentrate of auto shredder residue and for recovery of ABS/PC from consumer electronics, and is presently being evaluated for recovery of nylon. This process was a Discover Magazine Award finalist in 2000. Licenses for this technology are presently being negotiated with a number of firms.

Development of inert anodes for the magnesium industry. Recent work has identified certain metal alloys as promising candidate materials for nonconsummable anodes. A patent, U.S. Patent No. 6,083,362, *Dimensionally Stable Anode for Electrolysis, Method for Maintaining Dimensions of Anodes During Electrolysis*, was issued this year. Replacing current carbon anodes would significantly reduce emissions and improve the efficiency of magnesium and aluminum production. This project, which is

supported by Noranda Inc., focuses on understanding the surface behavior and stability of metal anodes at the electrolyte-anode interface.

Development of a "state of the art" Computational Fluid Dynamic (CFD) multi-phase reacting flow model of an advanced Fluid Catalytic Cracker (FCC). This model is being developed and validated through collaborative research and development agreements (CRADAs) with UOP, Chevron, BP Amoco, Ashland Oil, California Synfuels, and Process Innovators Inc. (PII). The FCC, a key process in a refinery, can be used to adjust product slates and/or increase specific product yields in response to market dictates, changing crude supplies, and environmental regulations. The CFD code is currently being used to define changes in operating conditions and design; and identify hardware improvements to an operating Chevron commercial FCC unit to alter the product slate, increasing gasoline yields and improving refining margins. A patent disclosure has been filed on a novel Fluidized Thermal/Catalytic Cracker concept that has the potential to increase yields by 5-10% over existing technologies.

Mission and Goals

The mission of the section is to develop and/or assist in the development of commercially viable new processes for industry.

Most of the Section's funding has been from OIT, with all projects cost-shared (at least 50%) by industrial partners. In the past, funding had been primarily from OIT's Chemicals and Steel Industries of the Future (IOF) Program. We now have major programs from the chemicals, aluminum, petroleum and glass IOFs. We expect to continue to receive a significant portion of our funding from OIT's IOF Program and are continually working to establish relationships with other companies, trade associations (e.g., Glass Manufacturing Industries Council), consortia (e.g., Secat) and universities (e.g., West Virginia University) to ensure that we are competitive.